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ABSTRACT

These instructional objectives, written by Ronald Gibson, have been selected from materials used at Golden West College (California). These objectives are offered simply as samples that may be used where they correspond to the skills, abilities, and attitudes instructors want their students to acquire. These objectives may also serve as models for assisting instructors to translate their courses into specific measurable terms. For other objectives in a related course see: ED 033 696 (Geology). (MB)

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Instructional Objectives for a Junior College Course in Physical Geology

Geology 1
Instructor: Ronald Gibson
Golden West College
Huntington Beach, California

Text: Gilluly, Waters, and Woodford
Principles of Geology
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Objectives

GEOLOGY I - STUDY GUIDE: CHAPTER 2 (MINERALS AND MATTER)

Upon completion of chapter 2 and review of associated material presented in the lecture, you should be able to:

Definition of Mineral

(2-1) 1. Define a mineral.

(2-2) 2. List those properties which are included in the definition.

Form and Structure of Minerals

(2-3) 1. Identify the term for the smooth exterior faces on minerals.

(2-4) 2. Discuss the constancy of interfacial angles.

(2-5) A. Give the reason for the constancy.

The Atomic Theory

(2-6) 1. List the three most important particles which make up atoms.

(2-7) 2. Outline the properties (mass, charge, position) of each of these particles.

(2-8) 3. In terms of the mass and volume relationships of atomic particles justify the statement that matter is for the most part void or empty space.

(2-9) 4. Correlate the chemical behavior of elements with their electron configuration.

(2-10) A. Give the most stable arrangement of electrons and how elements interact to achieve this stable form.

(2-11) B. List the two principal types of bonding.

(2-12) C. Outline the behavior of electrons in each type of bonding.

(2-13) 5. Outline how ions form and define an ion.

Internal Structure of Crystals

(2-14) 1. Discuss how x-ray experiment outline the internal structure of minerals.

(2-15) 2. Account for the difference between graphite and diamond on the basis of internal structure.

(2-16) 3. List the shape and composition of the primary "building block" of the earths crust.

GEOLOGY I - Study Guide: Chapter 2 (Minerals and Matter) continued

Variation in Chemical Composition of Minerals

(2-17) 1. Discuss the importance of ionic radii in terms of variation in composition.

(2-18) 2. Account for changes in ionic radii as ionization occurs.

(2-19) 3. Correlate increase or decrease in radii with change in electrical sign.

(2-20) 4. Outline the process of solid solution and give two examples of solid solution.

Mineral Groups

(2-21) 1. List the 8 most common elements (in order) which make up the bulk of the earths crust.

(2-22) A. List the two elements which occur together in most common minerals.

(2-23) B. Give the name of the mineral group containing these two elements.

(2-24) 2. List the common, rock-forming mineral groups.

Mineral Identification

(2-25) 1. List the various properties which can be used to identify minerals.

(2-26) 2. Give the characteristic properties of the feldspar group and list the method of distinguishing plagioclase from orthoclase.

(2-27) 3. Define and contrast fracture, cleavage and crystal form.

GEOLOGY I - STUDY GUIDE: CHAPTER 3 (THE RECORD OF THE ROCKS)

Upon completion of chapter 2 and review of associated material presented in the lecture, you should be able to:

Uniformitarianism

(3-1) 1. Discuss the concept of uniformitarianism.

(3-2) 2. Give the name of the worker who first stated the principle.

(3-3) 3. Define a rock and list the two parameters which are used in classification of rocks.

Sedimentary Rocks

(3-4) 1. List the two main subdivisions of sedimentary rocks.

(3-5) A. Contrast the origin and texture of the two groups.

(3-6) B. List the common rock types within each major group.

(3-7) C. List and give the function of the three components making up fragmental sedimentary rocks.

(3-8) 2. Discuss those properties of sedimentary rocks which enable genetic interpretations to be made.

(3-9) A. Correlate the textural features (sorting, rounding, size) of a sedimentary rock with its environment of deposition.

(3-10) B. Match a rock of given mineralogy with its typical environment of deposition.

(3-11) C. Given a certain physical feature (mudcracks, ripple, marks, etc.) list the probable environment.

(3-11) D. Given the environment of deposition, list the corresponding sedimentary rock you would expect to form.

(3-12) E. Select those sedimentary features which allow paleocurrent patterns to be established and discuss how such readings are made.

(3-13) F. Contrast those features associated with glacial sediments versus those typical of aeolian sediments.

Igneous Rocks

(3-14) 1. Discuss the controversy between Werner and Desmarest over the origin of basalt.

Geology I - Study Guide: Chapter 3 (The Record of the Rocks) continued

(3-15) A. List the evidence that Desmarest gave for the volcanic origin of basalt.

(3-16) B. Define scoria and account for its unique texture.

(3-17) 2. Name the two chief groups of igneous rocks.

(3-18) A. Contrast the origin of the two groups.

(3-19) B. Contrast the resulting texture of the two groups.

(3-20) C. Define and contrast dikes and sills.

(3-21) D. Outline the methods of determining the relative ages of different rock masses in contact with each other.

(3-22) 3. Classification of igneous rocks.

(3-23) A. Give the origin of fine grained, porplyritic, and coarse-grained igneous textures.

(3-24) B. Given the mineralogy and texture, supply the proper name to an igneous rock.

(3-25) C. Match the terms basic and acidic to the proper composition and order of crystallization from a magma.

(3-26) D. List those igneous rocks which are ejected into the atmosphere and give the evidence for such ejection.

(3-27) 4. Outline the evidence for both the magmatic and metamorphic origin of granitic rocks.

Metamorphic Rocks

(3-28) 1. Define foliation and give its origin.

(3-29) 2. List, in order of increasing grade of metamorphism, the various stages through which a shale goes in the transformation to gneiss.

(3-30) 3. Define each of these stages (or rocks) on the basis of texture and mineralogy.

(3-31) 4. Discuss the factors necessary for the fluid behavior of what appears to be solid rock.

(3-32) 5. List the two main origins of metamorphic rocks and discuss the criteria for identifying each.

Geology I - Study Guide: Chapter 3 (The Record of the Rocks) continued

(3-33) 6. List the two main agents of metamorphism and their correspondence to thermal and regional metamorphic rocks.

(3-34) 7. Correlate rock name (or classification) with texture.

GEOLOGY 1 - STUDY GUIDE: CHAPTER 4 (WEATHERING and SOILS)

Upon completion of Chapter 4 and review of associated material presented in the lecture, you should be able to:

Soil

(4-1) 1. Define soil.

(4-2) 2. Correlate climatic conditions with resultant soil.

(4-3) 3. Discuss the importance of identifying fossil soil horizons in the geologic record - especially the "ice ages".

(4-4) 4. Name the soil type which eventually leads to the earths major source of aluminum and give the climatic conditions under which it forms.

Weathering

(4-5) 1. List and define the two main categories of weathering.

(4-6) A. Discuss the most important agents of mechanical weathering; how they operate, where they predominate and their products.

(4-7) B. Discuss the process of chemical weathering.

(4-8) 1. Identify the chief natural acid responsible for chemical weathering.

(4-9) 2. Describe what happens to limestone when exposed to natural waters (in terms of chemical changes).

(4-10) 3. List the order in which the minerals of a granodiorite will yield to chemical weathering and list the minerals formed by the weathering.

(4-11) 2. Given a series of rocks, select these that would be least and most resistant to chemical weathering.

(4-12) 3. Contrast weathering processes in arid versus tropical regions.

(4-13) 4. Define and contrast exfoliation and jointing.

Residual Soil and the Soil Profile

(4-14) 1. Outline the principle zones (plant and mineral composition) occurring within a typical soil profile.

(4-15) 2. Discuss how the color of a soil indicates mineral composition.

Geology 1 - Study Guide: Chapter 4 (Weathering and Soils) continued

Climatic Factors in Weathering

(4-16) 1. Correlate specific soil type (i.e. caliche, alkali) with climatic conditions and account for the origin of each type.

(4-17) 2. Give the environment of formation, composition and apprarance of laterite.

(4-18) A. Outline the origin of laterite.

(4-19) B Discuss the origin of bauxite.

(4-20) 3. Correlate rate of weathering with climatic conditions and composition of bedrock.

GEOLOGY I - STUDY GUIDE: CHAPTER 5 (EROSION)

Upon completion of chapter 5 and review of associated material presented in the lecture, you should be able to:

THE LAW OF GRAVITATION

(5-1) 1. State the law of universal gravitation.

(5-2) 2. Relate the importance of gravity to the origin of other erosional agents (winds, water, ice) in addition to mass-wasting.

EROSION

(5-3) 1. List the five main agents of erosion.

(5-4) 2. Discuss the relationship between gravity, solar energy and the atmosphere - hydrosphere in terms of causing erosion.

RELATION OF WEATHERING AND EROSION

(5-5) 1. Outline the effect of toporgraphy (or slope) on both weathering and erosion.

(5-6) A. Give the relative rate of weathering to erosion in a steep, high mountain range.

(5-7) B. Contrast the rate above with that which would result in a flat, tropical area.

(5-8) 2. Reconstruct the rock cycle, showing the various steps involved and the products produced.

PROCESSES OF EROSION ON LAND

(5-9) 1. Discuss the importance of downslope movement (mass wasting) as a supplier of debris for other agencies and as an erosional process itself.

(5-10) 2. Give examples of long distance transport of material by wind and contrast the size of material carried in suspension with that transported along the surface.

(5-11) 3. Outline the mechanism of glacial erosion:

A. Account for the origin of "rock flour".

B. Account for the origin of glacial striations.

Geology I - Study Guide: Chapter 5 (Erosion) continued

(5-12) 4. Discuss erosional processes in the surf zone.

(5-13) 5. Outline the process of stram erosion and its relation to the hydrologic cycle.

(5-14) A. Define runoff, porosity, permeability, evapotranspiration and their role in the hydrologic cycle.

(5-15) B. List the various stages in the hydrologic cycle.

(5-16) C. List those factors which affect runoff and discuss exactly how each factor does affect runoff.

(5-17) 6. Define denudation and outline the variables involved in the rate of denudation of a given area.

(5-18) A. List and define the 3 distinct fractions of the total load being transportad by a stream.

(5-19) 1. Correlate the velocity of a stream with the dominant type of load.

(5-20) 2. Discuss how the type of load can change in flood stage and with climatic conditions.

(5-21) B. Contrast the load carried by streams in arid or semi-arid regions with those of temperate or tropical streams.

(5-22) C. Given a series of various environments, predict the dominant type of load transport and the relative rates of denudation.

(5-23) D. Assuming the present rate of denudation were to continue, state the amount of time necessary for the entire United States to be eroded down to sea level.

(5-24) E. Account for the numerous high mountainous areas on the crust despite the affects of denudation.

(5-25) F. List the changes on the rate of erosion when changes are made in vegetation cover.

EROSION BENEATH THE SEA

(5-26) 1. List the topographic provinces of the ocean.

(5-27) 2. Define a turbidity current.

(5-28) A. Give the composition (size and mineralogy) of a turbidity current.

Geology I - Study Guide: Chapter 5 (Erosion) continued

(5-29) B. OUtline the method of movement of a turbidity current.

(5-30) 3. State the evidence for the Grand Banks turbidity flow including the triggering mechanism, rate of flow, and drill core.

(5-31) 4. Cite other evidence for submarine erosion.

GEOLOGY 1 - STUDY GUIDE: CHAPTER 6 (GEOLOGIC MAPS) and APPENDIX I (MAPS & MAPPING)

Upon completion of Chapter 6, Appendix I, and review of associated material presented in the lecture, you should be able to:

Topographic Maps

(6-1) 1. Define a contour line and contour interval.

(6-2) 2. Correlate contour interval and spacing of contours with the steepness of topography.

(6-3) 3. Sketch or describe the configuration of contour lines as they encounter valleys or ridges.

(6-4) 4. By using a given map scale, convert a distance on the map to actual distance on the ground.

(6-5) 5. Define the term relief and contrast relief with maximum amount of elevation.

(6-6) 6. Contrast large and small scale maps in terms of size of area covered and use.

Geologic Maps

(6-7) 1. Discuss the early history of geologic mapping.

(6-8) A. Outline the contributions to mapping made by Cuvier and Bronqniart.

(6-9) B. Give the date, location and author of the first modern geologic map.

(6-10) C. Discuss the importance of Smith's establishment of stratigraphic succession.

(6-11) 2. State the four principles which are basic to the interpretation of sedimentary strata.

(6-12) 3. Define a geologic Formation, giving the two criteria for all formations.

(6-13) A. Define a geologic contact, along with the manner in which they are shown on geologic maps.

(6-14) B. Compare the methods used in constructing of geologic maps in well exposed areas vs poorly exposed areas.

Geology - Study Guide: Chapter 6 (Geologic Maps) and Appendix I (Maps & Mapping)

Geologic Maps continued

(6-15) 4. Account for the neceessity of correlation between two widely separated sequences of formations.

(6-16) A. List the four methods used in correlating units exposed on the surface.

(6-17) B. Contrast the above methods with those used by petroleum geologists in correlation beneath the surface of the earth.

Geologic Sections

(6-18) 1. Given a profile line on a geologic map, construct the geologic section.

(6-19) 2. Discuss the use of sections in industrial geology.

Rock Structure and Geologic Mapping

(6-20) 1. Define dip and strike.

(6-21) 2. Given smooth planes in various orientations, list the strike and dip for each.

(6-22) 3. Construct the appropriate map symbol for a given strike and dip.

(6-23) 4. State the "rule of V's".

(6-24) A. Given a set of topographic and geologic conditions, predict the configuration of outcrops.

(6-25) B. Given a map with topography only, sketch in the correct outcrop patterns for beds of specified orientation.

(6-26) 5. Discuss the relationship between topographic expression of formations either very resistant or very susceptable to weathering and construction of geologic maps.

GEOLOGY 1 - STUDY GUIDE: CHAPTER 7 (FOSSILS, STRATA, and TIME)

After completing Chapter 7 and reviewing associated material presented in the lecture, you should be able to:

Correlation and Faunal Succession

(7-1) 1. List the two implications of the fact that older fossils differ more from living organisms than do younger fossils.

(7-2) 2. Contrast Cuvier's and Darwin's explanation for the creation of a new species.

(7-3) 3. State the law of faunal assemblages.

(7-4) 4. List the necessary properties for all index fossils.

(7-5) 5. Discuss how the correlation of strata by their fossil assemblages is responsible for the establishment of the geologic column.

The Standard Geologic Column

(7-6) 1. List the Eras in their proper order.

(7-7) 2. List, in order, the Systems (or Periods) for each Era.

(7-8) 3. List, in order, the Series (or Epochs) for the Cenozoic periods.

(7-9) 4. Identify the System that contains the oldest abundant, hard shelled fossil remains.

(7-10) 5. Define a time-rock unit.

Geologic Time Scale

(7-11) 1. Define a time unit and contrast time units with time-rock units.

(7-12) 2. Discuss the establishment of a time scale from the world wide fossil record.

(7-13) 3. Outline the various problems encountered in using fossils for correlation.

Geology 1 - Study Guide: Chapter 7 (Fossils, Strats, and Time)

Geologic Time Scale continued

(7-14) A. Correlate between the length of time-range for a given species and its usefulness in correlation.

(7-15) B. Define and give the origin of sedimentary facies.

(7-16) 1. Define and give the origin of facies fossils.

(7-17) 2. List the free-floating organisms that are free from the affects of facies.

(7-18) 3. Account for the fact that environmental changes may cause reversals in the order of appearance of fossils.

Modern Estimates of Geologic Time

(7-19) 1. Duplicate the proceedure used by Jolly in showing that the oceans are at least 99 million years old.

(7-20) 2. Discuss radiometric age dating.

(7-21) A. Give the 3 particles emitted during radiometive decay and the part of the atom from which they originate.

(7-22) B. Define an isotope and outline how isotopes are formed through radioactive decay.

(7-23) C. Define half life and solve for the age of a rock given half life along with amounts of parent-daughter materials.

(7-24) D. List those factors which could result in errors in making an age date from a rock's uranium-lead ratio.

(7-25) E. Outline the K - Ar decay process and discuss the importance of K-Ar as an age dating tool in geology.

(7-26) F. List all of the isotopes or element pairs used in age dating.

(7-27) G. Give the oldest dates obtained radiometrically.

Geology 1 - Study Guide: Chapter 7 (Fossils, Strata, and Time)

Modern Estimates of Geologic Time Continued

(7-28) 3. Outline the formation, disintegration, and usefulness of radiocarbon as an age-dating tool.

(7-29) A. Identify the particular isotope of carbon used in age dating and the element from which it originates.

(7-30) B. Select the normal upper limit or maximum span of time for which radiocarbon can be used and the amount of parent material that would be present at the end of that time.

(7-31) C. Outline the basic theory of radiocarbon dating.

(7-32) D. Choose the correct portion of the geologic time scale for which radiocarbon dating is applicable.

GEOLOGY 1 - STUDY GUIDE: CHAPTER 8 (MOVEMENTS OF THE EARTH'S CRUST)

After completing Chapter 8 and reviewing associated material presented in the lecture, you should be able to:

Measurable Displacements of the Earth's Crust

(8-1) 1. Define a fault and a landslide and contrast the two.

(8-2) 2. List the amounts (in feet) of maximum displacement along faults as measured in historic time.

(8-3) 3. Compare the amounts above with those displacements indicated by ancient formations in fault contact with each other. Account for the difference between the two.

(8-4) 4. List the three relative directions of offset that can result from faulting.

(8-5) 5. Discuss the significance of regional patterns of movement, such as those of Kanto and Tottori.

(8-6) 6. Contrast movement due to faulting with that of broad, regional movement.

(8-7) 7. Discuss the movement of the earth's crust in the Scandanavian Pennsula and the Mississippi delta, giving the factors causing movement.

Geologic Evidence of Displacements of the Earth's Crust

(8-8) 1. List the geologic significance of coast lines dominated by estuaries (submergent coasts).

(8-9) 2. List the geologic significance of coast lines dominated by terraces (emergent coasts).

(8-10) A. Outline the process of formation of multiple-terraces.

(8-11) B. Give the evidence of recent geologic history for the Southern California coastline.

(8-12) 3. Outline the geologic evidence for both emergence and submergence in the Indonesia area.

Geology 1 - Study Guide: Chapter 8 (Movements of the Earth's Crust) continued

Contemporaneous Folding, Erosion and Deposition

(8-13) 1. Diagramatically show the evidence for contemporaneous folding and deposition in the (A) Maupin lava flows and (B) Signal Hill oil field.

(8-14) 2. Discuss how uplift, erosion and deposition is occurring simultaneously in the Cajon Pass area.

Folds That Have Ceased to Grow

(8-15) 1. Contrast geologic control of topography in areas of former movement with areas of active movement.

(8-16) 2. Account for the importance of resistant beds in areas which have reached equilibrium after a long period of uplift and erosion (i.e. Appalachian Mts).

Geology 1 -- Study Guide: Chapter 9 (Records of Earth Movements)

After completion of Chapter 9 and reviewing associated material presented in the lecture, you should be able to:

Warps and Gently Tilted Strata

(9-1) 1. Contrast a broadly warped area with a folded area
(9-2) 2. Outline the construction of a structure contour map
(9-3) A. Define a structure contour line.
(9-4) B. Give the method used in outlining a geologic structure from a structure contour map.

Folds

(9-5) 1. Define the various types of folds and identify each from a given geologic map or geologic section.
(9-6) 2. From a given set of map symbols, identify the type of fold. Given a particular type of fold, diagramatically show the proper map symbols.
(9-7) 3. Define the terms axial surface, axial plane, axis, crest line, trough line, and plunge.
(9-8) 4. Contrast competant versus incompetent folding
(9-9) 5. Compare the three dimensional configuarations of symmetrical, asymmetrical, recombent and isoclinal folds

Joints and Faults

(9-10) 1. Define and contrast faults and joints
(9-11) A. List the various origins of joints and faults
(9-12) B. Account for the origin of large scale faults.
(9-13) 2. List the different types of faults
(9-14) A. Define each variety on the basis of relative displacement
(9-15) B. Given a series of diagrams, identify the types of faults.
(9-16) 3. Account for drag effects exhibited by beds adjacent to faults and select the type of drag that would be produced by a given type of fault.
(9-17) 4. Discuss the artificial nature of fault classification, in particular how faults can change character.

Unconformities

(9-18) 1. Define and unconformity
(9-19) 2. Discuss the significance of unconformities in terms of geologic time.
(9-20) 3. Contrast the contact between igneous and sedimentary rocks that would result from intrusion with that of an uncomformity.
(9-21) 4. List, in order, the geologic events which result in the production of an unconformity
(9-22) 5. Select the proper time during the sequence of events involving unconformities that basal conglomerates are deposited.
(9-23) 6. Define and list the different varieties of unconformities.
(9-24) A. Give the origin of each type of unconformity
(9-25) B. Identify each type from a group of cross-sections
(9-26) 7. Outline how events can be dated by unconformities
(9-27) A. Given examples in cross section - state the time of the event from the age of formations involved

Regional Groupings of Structural Features

(9-28) 1. Describe the rock composition and structure of both contmental plates and continental shields

(9-29) 2. Put the continental shield and plate areas in their appropriate positions on the contments.

(9-30) 3. Contrast the rock composition and structure of folded belts with those of the shields and plate areas

(9-31) 4. Properly position the folded belts together with the shields and plate areas on the contiments.

(9-32) 5. Discuss the economic importance of the shield areas and the geologic age of shield rocks.

GEOLOGY 1 - STUDY GUIDE: CHAPTER 10 (GEODESY, ISOSTASY, AND STRENGTH)

After completion of Chapter 10 and reviewing of associated material presented in the lecture, you should be able to:

The Earth's Size and Shape

(10-1) 1. Outline the method Eratosthenes used in determining the circumference of the earth.

(10-2) 2. Compare polar versus equatorial circumferences.

(10-3) A. Give the difference between the earth's radius as measured at the poles and equator.

(10-4) B. Account for the difference between polar and equatorial dimensions.

(10-5) 3. Give the geometric shape which best describes the configuration of the earth.

The Earth's Maximum Relief

(10-6) 1. List the highest and lowest points on the earth's crust along with their elevation above and depth below sea level in meters.

(10-7) 2. Give the percentage of crust presently above and below sea level and discuss the effects of Pleistocene sea level changes on these percentages.

(10-8) A. List (in meters) the two dominant altitude levels of the earth's surface.

(10-9) B. Account for the presence of these two levels.

The Earth's Gravitational Field

(10-10) 1. Define the weight of an object as measured on the earth's surface.

(10-11) 2. Express the relationships between mass, distance and gravitational force.

(10-12) 3. List those factors which effect the gravitational force for an object on the earth's surface. Determine the effects will be to increase or decrease gravitational force.

Geology 1 - Study Guide: Chapter 10 (Geodesy, Isostasy, and Strength)

The Earth's Gravitational Field continued

(10-13) 4. Assuming you are measuring gravitational force with a pendulum - predict the effect on the period of the pendulum as you change elevation, latitude and density of near surface rocks.

(10-14) 5. Outline the behavior of a plumb line with regard to variations in surface topography.

ISOSTASY

(10-15) 1. Contrast the observed versus theoretical behavior of plumb lines near large mountain masses.

(10-16) 2. Account for the above difference in terms of the probable mass distribution involved with mountainous areas.

(10-17) 3. Discuss the concept of isostasy.

(10-18) A. Outline the findings of survey work carried out in India - especially the behavior of plumb lines near the Hinalayas.

(10-19) B. Account for the discrepancy between theoretical calculations and observed values of plumb line deflection with Pratt's model.

(10-20) C. Account for the discrepancy using Airy's model and contrast Airy's model with Pratt's model.

(10-21) D. Specify the behavior of the earth's substration as indicated by the "roots of mountains" concept.

(10-22) 4. Define and contrast the geoid and spheroid.

Gravity Measurements and Isostasy

(10-23) 1. Define a Bouguer gravity anomaly.

(10-24) 2. Correlate between the type of Bouguer anomaly and elevation.

(10-25) A. Account for the correlation between Bouguer anomalies and elevation.

(10-26) B. Contrast Bouguer anomalies for oceans and continents.

Geology 1 - Study Guide: Chapter 10 (Geodesy, Isostasy, and Strength) continued

Strength

(10-27) 1. Define the strength of a rock.

(10-28) 2. Give the general effect of temperature on rock strength.

(10-29) 3. Give the general effect of confirming pressure on rock strength.

(10-30) 4. Give the general effect of time on rock strength.

(10-31) 5. Discuss how strength of materials must be changed when scale models are used to duplicate geologic processes.

GEOLOGY 1 - STUDY GUIDE: CHAPTER 11 (DOWNSLOPE MOVEMENTS OF SOIL AND ROCK)

After completion of Chapter 11 and review of associated material presented in the lecture, you should be able to:

Variations of Downslope Movements

(11-1) 1. Define and contrast creep verus slow slides and debris flows.

(11-2) 2. Contrast landslides to the above types of movement.

Mudflows

(11-3) 1. List the conditions necessary for nudflows to occur.

(11-4) 2. Discuss the relationship of pyroclastic ejecta (ash) to mudflows.

(11-5) 3. Discuss the Zug, Switzerland flow.

(11-6) A. Give the angle of slope along which the flow moved. Account for the tendency of flows to move down slopes of lower angle under water as compared to above water.

(11-7) B. Give the cause of the Zug flow.

(11-8) 4. Define liquifaction and outline how this process was responsible for the 1964 flows at Seward and Valdez Alaska.

Creep

(11-9) 1. Identify those features which are indicative of surface creep.

(11-10) 2. Reproduce the process by which frost heaving results in the downslope creep.

(11-11) 3. List all of the processes which will result in creep.

(11-12) 4. Outline the process of solifluction.

(11-13) 5. Outline the conditions and series of events that led to the damming of the Gros Ventre River.

Geology 1 - Study Guide: Chapter 11 (Downslope Movements of Soil and Rock)

Creep continued

(11-14) 6. Give the conditions responsible for the Turnagain Alaska landslide.

(11-15) A. Give the type of rock present and the role of liquifaction.

(11-16) B. Diagram the type of block movement that occurred.

Rapid Slides, Flows and Falls

(11-17) 1. Define a talus pile.

(11-18) A. Give the origin and type of rock making up talus piles.

(11-19) B. Define the angle of repose and the factor that determines angle of repose.

(11-20) 2. Account for velocities reached and energy expended in large rockfalls.

(11-21) A. Give the explanation for undisturbed snow beneath the Sherman Glacier rock fall.

(11-22) B. Give the mechanism resulting in the destruction of trees 500 meters above Lituya Bay.

(11-23) C. Account for the extremely high velocities reached during the Elm rock slide and fall.

(11-24) D. Correlate the effect of compressed air on the mechanics of movement.

(11-25) E. List the cause and type of movement which occurred during the Vaiont Reservoir slide.

(11-26) (1) Give the geological factors responsible for the slide.

(11-27) (2) Account for debris on the opposite canyon wall at heights of 260 meters.

(11-28) 3 Identify the largest rock fall of recorded time and the height of the natural dam formed by the fall.

(11-29) 4. List those features that enable identification of a prehistoric slide or debris flow.

Geology 1 - Study Guide: Chapter 11 (Downslope Movement of Soil and Rock) continued:

Significance of Downslope Movements

(11-30) 1. In the case of rock walled canyons, compare the amount of material eroded by streams with that eroded by downslope movement.

(11-31) 2. Contrast the relative importance of downslope movement to stream erosion for a broad, meandering stream valley.

(11-32) 3. Discuss the importance of water in downslope movement.

(11-33) 4. List those features that an engineering geologist would look for in determining if a given area is undergoing active sliding.

CHAPTER 19 - EARTHQUAKES AND THE EARTH'S INTERIOR

Upon completion of Chapter 19 and review of associated material presented in the lecture, you should be able to:

Effects of Earthquakes

(19-1) 1. List those large earthquakes singled out for discussion by your author.

(19-2) 2. Select the earthquake that has had the greatest vertical displacement of any yet studied. Select the earthquake which resulted in the greatest reported loss of lives.

(19-3) 3. Name the fault and give the type of movement responsible for the San Francisco earthquake.

Causes of Earthquakes

(19-4) 1. Give the immediate cause of earthquakes.

(19-5) 2. Outline the elastic-rebound theory.

(19-6) A. Give the evidence for the above theory.

(19-7) B. Based on the theory, predict the behavior of a series of survey stations plotted at right angles to a strike-slip or lateral fault.

(19-8) 3. Give the term for giant oceanic waves produced by earthquakes. Account for such waves being produced <u>without</u> actual displacement of the sea floor.

(19-9) A. List the average velocity of such waves.

(19-10) B. List the maximum heights for such waves as recorded in historic time

Earthquake Waves and Their Transmission

(19-11) 1. List the three types of earthquake waves.

(19-12) A. Give the shape and relative velocity of each type of wave.

Earthquake Waves and Their Transmission continued

(19-13) B. Give the order in which the waves would arrive at a distant seismograph station.

(19-14) 2. State the relationship (proportional-inversely proportional) between velocity, density and resistance to shear for both transverse and compressional waves.

(19-15) 3. List the products produced when P and S waves encounter a discontinuity and describe what happens to the travel path of the original P and S waves.

(19-16) 4. List the type of wave responsible for surface damage from earthquakes.

Seismographs

(19-17) 1. Describe the principal by which a horizontal pendulum seismograph works.

(19-18) 2. From the time-distance curve, describe the velocity of P and S waves with regard to travel distance and depth within the earth.

(19-19) 3. Describe the changes in rigidity and density as depth below surface increases.

(19-20) 4. Define and contrast the focus and epicenter of an earthquake.

(19-21) 5. Outline how earthquake epicenters are located using P and S wave lag times.

(19-22) 6. Define and contrast earthquake intensity and magnitude.

(19-23) A. Give the scale used to express intensity and how the scale is defined.

(19-24) B. Define an isoseismal line.

(19-25) C. Give the scale used to express earthquake magnitude and account for the fact that intensity is not a measure of the size of an earthquake.

(19-26) (1) Give the basis for the scale.

(19-27) (2) List the amount of amplitude increase and energy increase for each number on the scale.

Seismographs (continued)

(19-28) 7. List the maximum depth of deep focus earthquakes and what their existance tells us about the behavior of the earth at such depths.

(19-29) A. Locate, geographically, the zones of deep earthquakes.

(19-30) B. Reproduce the pattern formed by deep-focus earthquakes as the foci are plotted against depth (at right angles to the arc trend).

(19-31) 8. List the number of earthquakes occurring each year which are strong enough to be felt and the average number of great earthquakes occurring each century.

(19-32) 9. List the major earthquakes belts of the world.

The Crust of the Earth

(19-33) 1. Discuss the evidence used by Mohorovicic in defining the crust-mantle boundary.

(19-34) 2. Give the range in continental crust thickness and the seismic evidence for the "Roots of Mountains" hypothesis of Airy.

(19-35) 3. Correlate seismic velocities with both crustal and mantle density differences. Predict what the velocity would be in mountains of light (or heavy) crustal rocks or in upper mantle of light (or heavy) density.

(19-36) 4. Describe the composition of the continental crust, in terms of dominant elements and average rock type.

(19-37) 5. Describe the composition of the oceanic crust (and lowest layer of continental crust) by dominant elements and rock type.

(19-38) 6. Give the name of the zone which occurs below both oceanic and continental crust.

(19-39) 7. Compare the thickness of oceanic crust with that of continental crust.

The Deep Interior

(19-40) 1. Outline the behavior of P and S waves as they travel through the mantle and account for their change in velocity by the physical properties of the mantle.

(19-41) 2. Outline the behavior of P and S waves from the mantle to the center of the earth.

(19-42) 3. Give the depth to the outer core, the physical state of the outer core and the seismic evidence for the existance of such a core.

(19-43) 4. Account for the shadow zone in terms of P and S wave behavior.

(19-44) 5. Give the physical state and depth of the inner core.

A Model of the Earth

(19-45) 1. Based on all available data, reconstruct the various zones of the earths interior giving their physical state.

(19-46) 2. Contrast the units that would be encountered in a hole drilled on a continent down into the mantle with a hole drilled on the ocean floor down into the mantle.

(19-47) 3. List the best estimates as to the composition of the mantle and core.

(19-48) 4. Predict how the weight (or gravitational force) would change as different parts of the "Jolly" balance are changed.

(19-49) 5. List the calculated density for the earth as a whole and the measured density of surface rocks.

(19-50) 6. Give the proceedure used in finding the density of interior zones of the earth by both seismic and rotational inertia analysis.

(19-51) A. Outline the relationship between mass distribution and rotational inertia.

(19-52) B. List the probable density of material at the center of the earth.

Temperature Within The Earth

(19-53) 1. Identify the average temperature gradient within the earth.

(19-54) 2. List those factors which control the amount of heat lost and how each effects heat flow.

(19-55) 3. Select those areas on the continental and oceanic crust that are the locations of abnormally high or low heat flow.

(19-56) 4. List the main source of earth heat.

(19-57) 5. Outline the distribution of radioactive elements both in the interior of the earth and on the surface.

(19-58) A. Compare the theoretical versus the measured heat flow over continents and oceans.

(19-59) B. Correlate radioactive content with differentiation.

(19-60) C. Account for the difference in heat flow for the eastern and western Sierra Nevadas.

(19-61) D. Discuss the evidence for and probable origin of "hot spots" of magma within the mantle.

(19-62) E. Explain the history of earth heat since the beginning of the earth on the basis of radioactive decay.

The Earth's Magnetic Field

(19-63) 1. Define the Curie point of a substance and show how, on the basis of Curie point and geothermal gradient, the interior of the earth is not magnetic.

(19-64) 2. Outline the dynamo theory as an explanation of the earth's magnetic field.

(19-65) 3. Discuss the "wobbling" or migrating nature of the earth's magnetic poles around the geographic poles.

(19-66) 4. Discuss changes in the intensity of the earth's magnetic field in historic time.

(19-67) 5. Outline the findings of paleomagnetic studies.

(19-68) A. Account for the fact that rocks can be used to indicate the orientation of the earth's magnetic field at the time the rocks were formed.

The Earth's Magnetic Field continued

(19-69) B. Contrast the indicated position of the north magnetic pole determined by several present day readings (Fig. 19-27) against that determined by readings from rocks over a period of 1/2 million years (Fig. 19-28). Relate this comparison to the average position of the earth's magnetic pole.

(19-70) C. Give the evidence for reversals in the earth's magnetic field through time.

(19-71) (1) List the length of time to the last reversal.

(19-72) (2) Give the amount (estimated) of time it takes for one reversal to occur and the probable effect on the Van Allen Radiation Belts (and life on earth).

GEOLOGY 1 : Study Guide - Chapter 20 (Mountains)

After completion of Chapter 20 and reviewing associated material presented in the lecture, you should be able to:

Mountains

(20-1) 1. Define mountains on the basis of structure and compare with plateaus. List the main geologic categories of mountains.

(20-2) 2. Compare the relief of mountains with plateaus.

Fold Mountains

(20-3) 1. List the predominant rock type as well as structure of fold mountains.

(20-4) 2. Define a geosyncline.

(20-5) A. Compare the rate of sedimentation with the rate of sinking of geosynclines and correlate the two rates with the thick sequences of shallow water sediment found in geosynclines.

(20-6) B. Outline the three zones or subdivisions of geosynclines.

1. Correlate these zones with the miogeosyncline and eugeosyncline.

(20-7) 2. Contrast the sedimentary rocks forming in the miogeosyncline with those being deposited in the eugeosyncline.

(20-8) 3. List the chief source area for most of the sedimentary debris.

(20-9) 3. Outline the structure of the Appalachian Mountains.

(20-10) A. List the structural zones traversed from NW to SE.

(20-11) B. List the dominant structural feature in each zone.

C. Correlate the type of structures present with the width of crust before and after deformation.

(20-12) 4. Outline the structure of the Alps

(20-13) A. Relate the presence of evaporite beds to thrust faulting.

(20-14) B. Compare the structure of the Alps with that of the Appalacians.

(20-15) C. Account for disharmonic structures.

(20-16) D. Reconstruct the layered sequence of thrust sheets of the Alps showing successive displacement.

(20-17) E. Place the flysch and molasse sequences in their appropriate position in terms of the evolution of geosyncline to mountain range.

Fault-Block Mountains

(20-18) 1. Contrast the structure and origin of fault-block mountains with fold mountains.

(20-19) 2. Reconstruct the geologic structure of the Sierra Nevada fault block.

(20-20) 3. Describe the structure and resulting topography of the basin and range province.

(20-21) A. Identify the predominant fault type.

(20-22) B. Correlate the fault type with either crustal compression (shortening) or extension.

(20-23) 4. Discuss the presence of ault-blocks at the center of mid-ocean ridges.

Mountains Beneath The Sea

(20-24) 1. Outline the position, composition and heat flow of both island arcs and their accompanying trenches.

(20-25) 2. Discuss the shape, structure and composition of the mid-oceanic ridges.

(20-26) 3. Contrast the width and symmetry of mid-oceanic ridges with mountain ranges on the continents.

(20-27) 4. Define the type of movement occurring on the transverse faults which cut across mid oceanic ridges and give the amount of displacement along such faults.

(20-28) 5. Compare the heat flow over mid-ocean ridges with the flat ocean basins.

(20-29) 6. Contrast oceanic ridges with oceanic rises.

The Isostasy of Folded Belts

(20-30) 1. Given the specific gravity of the sialic crust (2.7) and the upper mantle (3.3) along with the increase in thickness of the sial, calculate the compensating depression in the mantle.

(20-31) 2. Account for the fact that erosion of a mountain range can result in an increase in the summit level rather than a decrease.

(20-32) 3. Outline the products which are formed in the deep roots of geosynclines over a period of time.

Oceanic Deeps and the Belts of Negative Anomalies

(20-33) 1. Correlate the position and occurrance of ocean deeps, island arcs, volcanoes, and earthquake foci with regard to the contact of oceanic with continental crust.

(20-34) 2. Outline the results of gravity surveys taken over ocean deeps.

(20-35) A. Give the type of gravity anomaly associated with ocean deeps.

(20-36) B. Identify the origin of these anomalies.

(20-37) C. List the stress distribution within the crust and mantle that would account for the anomalies.

(20-38) D. Predict the effect of removing the stress responsible for the formation of an ocean deep.

Speculations Regarding Mountain Building

(20-39) 1. List those items which indicate that the earth has been shrinking since its origin.

(20-40) 2. Outline the evidence supporting continental drift including:

(20-41) A. The "fit" or match of continents.

(20-42) B. Stratigraphic similarities between continents.

(20-43) C. Distribution and direction of movement of ancient glacial deposits.

(20-44) D. Paleomagnetic studies - the apparent position of the earth's magnetic poles through geologic time.

(20-45) 3. Construct a working model, based on the convection theory, to account for continental drift and sea-floor spreading.

(20-46) A. Identify the cause of convection currents.

(20-47) B. Locate zones of upwelling and downwelling within the earth's crust.

(20-48) C. Correlate heat flow, seismic, gravity, and magnetic evidence with convection and sea-floor spreading.

(20-49) D. Reproduce the magnetic patterns and the age of the sea floor in moving out from a mid-oceanic ridge.

(20-50) 4. Compare the age of the oceanic water to the age of the ocean floors.